An Innovative New Home

Warrior Home
Student Design Team
University of Waterloo
Waterloo, ON, Canada
info@warriorhome.ca

WARRIOR HOME

Engineering Narrative

U.S. Department of Energy
Solar Decathlon 2020
Build Competition

Kaikaiknong Crescent Development
Engineering Narrative
BC_WH_JURYENG
Submission Date: 03/02/21

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We intend to raise the bar for energy efficient, affordable, safe and healthy homes for our membership by continuously focusing on a holistic approach to our builds with improved standards, innovative partnerships and utilizing the latest building technology available.

Greg Nadjiwon
Chief, Chippewas of Nawash

Introduction

The Chippewas of Nawash Unceded First Nations community located on the Neyaashiinigmiing Reserve in Southwestern Ontario forms an integral part of the rich tapestry that is Canada's indigenous heritage. Like many Indigenous communities, however, access to adequate housing for all of its members is often a large challenge and one that is not sufficiently addressed by provincial and federal governments. With growing families and the return of community members wishing to live on their lands, the demand for good-quality, affordable housing that meets the needs of each Chippewas of Nawash community member kept rising. As a result, Warrior Home's entry for the Solar Decathlon Build Challenge aimed to address the housing crisis present in Canada's Indigenous communities through the design and construction of a sustainable home that also addresses the cultural and societal needs of the homeowner and community.

From 2018 to 2020, Warrior Home has worked closely with the Chippewas of Nawash to design and build a net-zero energy home that was made to accommodate the specific needs of the residents of the Neyaashiinigmiing Reserve. The team was able to partner with the Habitat for Humanity Grey Bruce to build a net-zero energy home in the Kaikaiknong Crescent development. After extensive consultation with community leaders, community members and the family that was set to receive the home, Warrior Home was able to develop an innovative and affordable design that integrates energy efficient technology, high-performance engineering systems as well as aesthetics, ergonomics, and Indigenous cultural integration. By December 2019, students and local volunteers were able to complete the construction of the Warrior Home design and a family of 5 was able to move in.

During the design process, the integration of the various engineering systems of the home were addressed, such as the building envelope, mechanical systems, architecture and solar, water and electrical systems. Technologies such as enhanced insulation, a raised heel roof truss, photovoltaics, efficient plumbing and HVAC systems as well as advanced structural framing techniques optimized the house's overall performance.

What fueled the team to complete the design and help build the net-zero energy home were ultimately the wonderful people in the community, which include the housing authority, Chief and Band Council, the homeowners, a mother named Melissa and her four kids, and many others met throughout the process. Their unique stories and needs propelled the design for the home, which itself contributed towards the promotion of sustainable development within First Nations communities.

Approach

Warrior Home strived to solve and holistically integrate the solutions to the engineering challenges presented by this competition with a high level of quality and attention to detail. High-performance engineering systems have been considered in all aspects of housing design to ensure efficiency while meeting occupant needs. During the design process, focus was placed on the integration and quality of the various technical components of the home, including the building envelope, mechanical systems, home architecture and the solar, electrical and water systems.

With so many facets of design to be solved throughout the duration of this competition, Warrior Home ensured that there was copious collaboration between the respective sub-teams engaged in the engineering design process. In conducting research and applying knowledge obtained from experience our members had gained during their co-operative work terms, market-leading technologies were implemented in tandem with an integrated multi-disciplinary design.

The architecture of the home deviates from the typical North American home design and incorporates aspects that reinforce traditional Indigenous values, customs and traditions. To do this, long-term research and user-feedback surveys were conducted with the indigenous community prior to the design process to get a sense of what features the community desired and what needed to be modified from the standard home design so that it fit with the Indigenous community and way of life. Structurally-speaking, the design team made the innovative choice to implement advanced framing instead of standard framing for this build. Advanced framing places studs directly below joists or rafters in order for load to be transferred straight through the studs, allowing for more insulation to be included within the wall cavity. Additionally, raised heel trusses were implemented in order to maximize insulation underneath the roof trusses. Having this layer of insulation in the ceiling enhanced the home's energy retention performance. Seeing as the structure is situated in a northern climate, such innovative decisions were critical to achieve an energy neutral rating. By integrating these building envelope ideas into the structural design, Warrior Home was effectively able to save on energy cost for the homeowner.

$404
Annual Electrical Bill Savings

50%
Annual Water Bill Savings

55%
Reduction in Energy Usage Compared to an Average 4-Bedroom House Before Net Metering

The Warrior Home was designed to be a very high performance, energy efficient home. It was designed to use 55% less energy than traditional homes of the same size. There are many different technologies that were implemented into the design, such as smart plugs and smart thermostats, that allow the homeowners to minimize and keep track of their energy usage, both at and while away from home. Regarding energy production, the home generates enough energy via solar panels to create a net-zero annual energy design.

NET ZERO

11,135 kWh
Less Energy Used per Year Compared to Baseline Average

The panels are also expected to produce more energy than the house consumes, which will be sold to the grid in exchange for credits. The credits could be used to provide energy for the house during times of insufficient sunlight exposure. In addition, the production of clean and renewable energy will contribute to a cleaner grid in Ontario.
The home is also designed to be energy efficient from a plumbing and water perspective. A hybrid-electric water heater tank and heat pump pairing is installed in the home which provides the convenience and reliability of a water tank while achieving great efficiency. The pipes throughout the home are made of cross-linked polyethylene (PEX) pipes, instead of the typical copper pipes, as they are better insulated to minimize energy losses and can withstand freezing temperatures. Low-flow fixtures were installed over conventional fixtures to minimize water usage by up to 50%. High-efficiency washing machines were also installed which require less water, energy, and detergent to wash clothes, resulting in lower household costs.

All of these technologies implemented in the home were determined through an iterative process in which each sub-team could contribute thoughts on the impacts of design decisions. It is through this forward-thinking and holistic approach that the engineering design was fully integrated across each discipline.

Designed and Built for an Affordable and Sustainable Future

Design

The proper functionality of house systems and architectural details have been designed to work synergistically. This includes having a floor plan that accounts for the space needed for mechanical systems, such as pipes and ductwork, while maintaining suitable space for user comfort. In addition to this, a mechanical room will be used to store and provide easy access to HVAC and water heating equipment.

Since the framework currently employed by Habitat for Humanity relies heavily on the use of volunteer construction labour to help cut down labour costs, the design was made to be simple enough for volunteers with little-to-no construction experience to assemble, and not require a specialist to install. If a specialist was required, this labour was kept to a minimum. This impacted the building enclosure and architecture by keeping the building simple and compact, as well as the installation of any mechanical equipment, plumbing, and ductwork.

In terms of the building enclosure design, the thermal performance was optimized by using 2 inches of XPS insulation on the exterior, and 5.5 inches of fiberglass batt in the interior cavities between the 2 by 6 studs, resulting in an R-value of 30. The choice to delegate some of the insulating controls to the exterior XPS was done to minimize thermal bridging through the wood studs. By adopting an exterior layer of insulation, it was possible to achieve a higher effective R-value due to the minimization of thermal bridging, and also negate the need to increase the width of the stud and cavity space to a 2 by 8 or more to accommodate for the same level of insulation. Though the cost of adding 2 inches of XPS on the exterior of the OSB was significantly greater than increasing the depth of the studs and adding additional fiberglass batt insulation between the cavity, it proved to be more effective. The material used is relatively standard; however, the positioning of each control layer incorporates recent research findings and techniques to prevent some of the common problems that usually occur with building enclosures.

The ideology of one-half of the insulation on the exterior, and one-half of the insulation on the interior is a design choice that resulted from prior research conducted by the Cold Climate Housing Research Center (CCHRC). Our original intention was to include more exterior insulation, however, our clients were concerned with the cost of larger screws and the ability for volunteers to accurately install everything as appropriate. It is an adaptation of the technique called R.E.M.O.T.E wall, where the majority of insulation is installed on the exterior of the sheathing (and the rest of the structural supports). This R.E.M.O.T.E ideology was adapted for Warrior Home's circumstances, to best fit the client's needs while maintaining optimal energy efficiency. The increased additional continuous rigid insulation for the wall assembly reduces the level of thermal bridging that occurs, as well as adding to the overall insulation and thermal control of the house. The adoption of a warm roof design for the roof is also a measure to reduce the thermal bridging that occurs.

Natural comfort is ensured through the design of a well-conditioned space, achieved through the use of passive home design techniques. The multiple south-facing windows allow for passive solar gain during the winter season, and when paired with the appropriate shading techniques, it controls the amount of solar energy that filters through the windows during the summer season. Passive solar gain measures were adopted to maintain a conditioned indoor environment without excessive strain placed on the HVAC system.

The home was designed to ensure comfort year-round, today, and for many years to come. The maintenance of occupant comfort and environmental quality relates to resilience and durability and as such, these two aspects were important to the team during the design. For instance, durability relates closely with occupant comfort in the moisture-control sector. With a poor building enclosure design, there is a high potential of moisture build-up in the building assembly. This moisture build-up could lead to structural deterioration as well as mold and pest problems which could lead to poor occupant health. Furthermore, with select thermal insulation materials, there are also some associated health risks. Some of the materials settle, or breakdown as its lifespan wears out, which is related to both the durability of the structure, as well as occupant comfort and safety. Warrior Home's design ensures that these negative scenarios are mitigated or avoided entirely. The HVAC system consists of a central heat pump connected to an air handling unit (AHU) coupled with a heat recovery ventilator (HRV) unit - a system optimal for maintaining occupant comfort year-round.

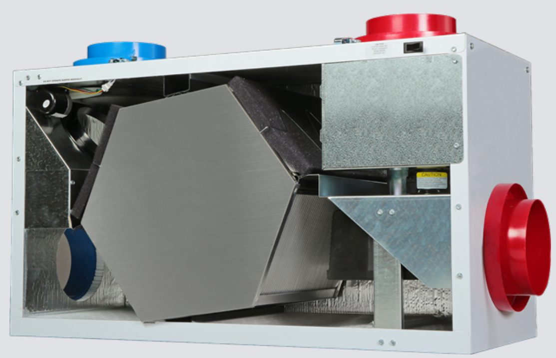


Figure 1
Lifebreath RNC 155 Heat Recovery Ventilator
Image Source: Lifebreath

The HRV ventilates the home by supplying the proper amount of fresh air into the space and exhausting stale air from areas with high heat and humidity, such as bathrooms, using circular ductwork. This removes excess humidity in the space and reduces odours overall, improving the air quality of the home. A Lifebreath RNC 155 HRV unit, as shown in Figure 1, was selected with an airflow of 132 cfm and a sensible recovery efficiency of 75%. Additionally, the HRV repurposes the otherwise wasted outgoing air to preheat or pre-cool the incoming fresh air. This reduces the work needed to condition new air, making the system more energy-efficient. In order to optimize performance and efficiency, many options were considered for the ventilator unit such as an energy recovery ventilator (ERV). However, the high indoor relative humidity (RH) with an entire family in the home posed an issue. During the winter, the ERV would bring unwanted humidity back into the house, increasing RH levels. This would result in uncomfortable conditions and risks condensation forming on the windows, obstructing outdoor light from coming in and potentially leading to moisture damage. This led to a final design decision to choose the heat recovery ventilator to ensure the comfort of the tenets.

The home's lighting system was designed to combine considerations of the ambient natural daylighting, energy efficiency, occupant use and lighting aspects for the home's visually impaired occupant. By including more light fixtures than would typically be seen in a home, and bulbs with adjustable brightness, the visually impaired occupant was thoughtfully accomodated. In addition to this, the lighting setup also provided a means for the occupants to adjust the lighting to suit the mood or activities occurring in the home, at any time of day. These bulbs were also ensured to be EnergyStar-rated LED light bulbs to reduce the electrical load on the home.

To ensure long-term sustainability, Warrior Home's design achieves net-zero energy with renewable energy generation. The house is fully electrified to eliminate on-site production of greenhouse gases and minimize the carbon footprint of the house. Every aspect of the house includes elements of energy-efficiency to improve the overall energy performance.

For instance, roof mounted solar panels provide on-site energy generation, which has been designed to be able to power all critical loads in the house on-demand. On-site storage has not been implemented into the constructed house, as it was not economically feasible to do so, however the design is flexible to accommodate battery storage, if required in the future. Alternative net-energy metering was considered instead, to provide power to the house when solar energy is not available. Before any considerations towards the unit's generation of solar energy are made, the unit achieves a HERS score of 45. Once solar generation is considered, the unit achieves the lower score of -14. Energy modelling outputs used to determine these values are attached in Appendix A of this document. Annually, the unit has a net consumption of 14,500 ekWh that is offset to -1,880 ekWh after photovoltaic generation. This indicates that not only is the unit net-zero, but that it is able to produce more energy than it requires. The housing unit also has the capability to shed the majority of its load in response to received requests from a local utility. Based on design modelling, 37 solar panels, each 365 Watts in capacity, are ideal for meeting the energy demands of the design. The panels are divided into two strings of 13 panels and one string of 11 panels. The back roof of the housing unit provides enough space to mount all the necessary panels. The orientation and quantity of the photovoltaic solar panels cells installed on the roof are necessary in achieving a net-zero energy balance and total cost.

Another important component of a functional house is a plumbing system that allows for efficient hot water delivery to the kitchen, laundry systems and the two bathrooms. For this, a hybrid design that pairs a dielectric water heater tank with a heat pump was selected. In addition, a heat exchange recovery system is used to absorb heat from greywater in order to heat returning water and further save energy.

An additional aspect of an optimal plumbing system is the integration of several low-flow water fixtures to reduce the use of large quantities of water and of hot water. This is applicable for sink faucets, toilets and showerheads. Using a low-flow fixture can save up to half the amount of water as compared to regular fixtures.

This reduction in hot water usage also allows for the use of a smaller water tank compared to a conventional house of the same size. This water heater tank is located near the center of the house which helps minimize heat loss in pipes as less piping is required to deliver hot water to all required locations. Furthermore, for this piping, cross-linked polyethylene (PEX) is used rather than copper as it is better insulated and hence minimizes energy losses.

Water conservation occurs through rain collection through the multiple barrels strategically placed around the buildings perimeter, as well as an onsite rain garden to treat polluted stormwater runoff. The addition of landscaped vegetation promotes sustainable agriculture, improves ecology, and reduces water runoff. Water is conserved onsite through the implementation of two rain barrels, collecting water that falls on the roof and storing it for future garden-watering during dry spells. The landscaping of the home was developed with a careful consideration of what is regionally appropriate through the utilization of native species and resilient, sustainable planting choices. The drainage and grading of the site were also well implemented; prior to the start of construction, the site was cleared and a firm was engaged to implement industry standard grading and drainage systems on the site.

Efficiency and Performance

The Warrior Home design team made the innovative choice to implement advanced framing instead of standard framing for this build. As mentioned earlier, advanced framing places studs directly below joists or rafters in order for the load to be transferred straight through the studs. Advanced framing minimizes P-delta effects that studs commonly experience due to eccentric loading. Larger stud spacing and a single top plate resulted in less lumber required than in a conventional framing scheme. This saves material costs as well as improves the thermal performance of the building since more insulation could be placed in the wall. The insulation used in the walls had an R value of 3.75 per inch, whereas SPF studs only have an R value of 1.25 per inch. With those values in mind, it is obvious that having fewer studs and more insulation is advantageous. A 2 by 6 stud size was selected over 2 by 4 to increase the durability and stability of the home. This also allows for more insulation to be included within the wall cavity. By integrating building envelope ideas into the structural design, Warrior Home was effectively able to save on energy costs for the homeowner.

Additionally, raised heel trusses were implemented in order to maximize insulation underneath the roof trusses. By collaborating with the Warrior Home Building Envelope team, the structure of the home was modified. Having a layer of insulation in the ceiling enhanced the home's energy retention performance and seeing as the structure is in a northern climate, such innovative decisions were critical to achieve an energy neutral rating.

Just as the interaction between the structural system and the building enclosure were carefully analysed and designed in tandem, so too was the space-conditioning system expertly integrated with the building's structural system. The home uses an outdoor heat pump that transfers heat to and from an indoor air handling unit using refrigerant lines. Heat pump technology uses a system typically seen in a refrigerator or air conditioner and is very energy efficient. The Coleman AVC36BX21 AHU - pictured in Figure 2 - consists of a refrigerant coil, a blower, and a backup electric resistance heating coil and can provide a supply airflow of 800 cfm. Fresh, semi-conditioned

Figure 2
Coleman AVC36BX21 Air Handling Unit
Image Source: Coleman

ventilation air is provided directly to the return section of the heat pump air handler. This way, the blower on the air handler is used to distribute the ventilation air through the heating and cooling ductwork. Ductwork was strategically planned to ensure minimal disturbance to the structural system in the early stages of design.

In addition to heating the water with electrical resistance, the heat pump uses a compressor and refrigerant to heat the water with ambient heat from the surrounding air. By transferring heat from the outdoors instead of producing it, the pump can provide more energy output than the electric power used for operation.

Another benefit of the selected heat pump is that it has 2-stage compressor operation; it can provide only a partial heat supply when a full heat supply is not required, further reducing energy use. They can also switch between operating in heating mode and cooling mode, essentially providing two units in one package. In total, the heat pump is estimated to save up to $404 annually on the electricity bill. The design heating load for the home was around 12,500 BTU/h. Due to the limited availability of heat pump units in the area, the system needed to be oversized. The selected Coleman HC19B2421S heat pump, as shown in Figure 3, has a total cooling capacity of 24.6 MBH, heating capacity of 23.6 MBH with a seasonal efficiency of 18 SEER and efficiency of 14 EER.

Figure 3
Coleman HC19B2421S
Heat Pump
Image Source: Coleman

Since no exterior vents needed to be installed for the ductless range hood (as it recirculates the air), energy losses resulting from exhausting interior air or any heat loss through the exterior penetration were eliminated. This also means that ductless hoods were much easier to install.

This comprehensive space-conditioning system was designed and installed to ensure full air mixing in all rooms of the home. The AHU is connected to ductwork which runs throughout the home to supply air to bedrooms and common areas, and return air from the hallways. The supply and return grilles are placed on or near the floor, which prevents stratification whilst heating the space - reducing the total ductwork required. Another element to the design is the ductless range hood for the kitchen cooktop exhaust. The hood utilizes a normal aluminum mesh filter that a ducted hood would use as well as a charcoal filter, which cleans the exhaust air and allows it to be recirculated back into the kitchen.

Water efficiency was also considered early in the design process to ensure seamless integration with the other systems and functionality of the home. For the home's design, a combination of an instantaneous electric tankless water heater, heat recovery system and heat pump helped minimize the energy required to deliver hot water through the home. These innovative housing systems also account for the space and energy restrictions in a small, off-grid housing unit.
An additional aspect of an optimal plumbing system is the integration of several low-flow water fixtures to reduce the use of large quantities of water and of hot water. This is applicable for sink faucets, toilets and showerheads. Using a low-flow fixture can save up to half the amount of water as compared to regular fixtures. This reduction in hot water usage also allows for the use of a smaller water tank compared to a conventional house of the same size.

While much thought was put into the design with regards to immediate use and performance, equal thought was put into the longevity and maintenance plans for the home. This long-term vision was another key driver of the design. For one, the design was made to be simple enough for volunteers with little-to-no construction experience to assemble, and therefore would not require specialists. This is beneficial during the construction process, but also for when any maintenance needs to occur. By keeping the building design simple, any maintenance that needs to be performed can be done more easily.

The design also adopted passive solar gain measures to maintain a conditioned indoor environment without excessive strain placed on the HVAC system. HVAC systems were selected with the thought towards whether local repair trades would be knowledgeable enough to conduct maintenance should problems arise.
The solar energy generated is incorporated into the net energy metering system, allowing the surplus energy that is produced to contribute to a cleaner grid in Ontario. This system also allows for generated energy to be used at any time, rather than solely when it is generated. Alternative to energy storage, net energy metering is more feasible and economical for a low-income family to operate efficiently.
They would not have to incur the costs associated with maintaining a battery as it was estimated the batteries available in the region would require replacement approximately every 8 years, costing upwards of $10,000 CAD.

Lastly, the maintenance of occupant comfort and environmental quality relates to resilience and durability and as such, ensuring the home's durability and resilience were important to the team during the design. Durability relates closely with occupant comfort in the moisture control sector. With a poor building enclosure design, there is high potentiality of moisture build-up in the building assembly.

The moisture build-up could lead to structural deterioration, mold and pest problems; mold and pest problems could lead to poor occupant health. In ensuring our design was durable and followed building science principles, an airtight, moisture mitigating design was constructed, resulting in a reduced need for maintenance down the road.

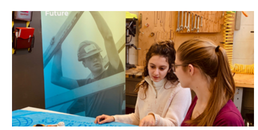
While the thought that goes into the design is incredibly important for the success of the home long term, it is also important to ensure that the occupants of the home are able to understand and use all of the features well so that the home can operate as designed. There were many different technologies implemented into the home, such as smart plugs and smart thermostats, that allow the homeowners to minimize and keep track of their energy usage, both at and while away from home. The development includes a Google Nest smart thermostat to help regulate the energy being used in the home by providing homeowners with an easy-to-use interface for temperature control. With internet connectivity capabilities, the homeowners can manage the heating or cooling remotely through their phones or by setting temperature schedules. A unique condition of this design is that the home does not provide cooling as requested by the community. This is to prevent an inequality between the community since the rest of the development does not have cooling. To accommodate this, the Nest's thermostat settings are password-locked for cooling and the community council can unlock the thermostat when the heating season begins. Furthermore, they could choose to permanently unlock the thermostat upon community agreement to add the feature in future homes. The homeowners were instructed on how to best use interior shading devices, the set points on their mechanical systems and smart plug load usage.

Documentation

The competition drawings clearly reveal the intent of the design, and show how goals were achieved through materials, construction and layout. The opening render displays the vision of the home, and allows the audience to understand the aesthetics and layout. The floor plan layout, along with the exhibit logistics clearly show the placement of rooms and interior finishes in the space, and how the space can be used to ensure maximum comfort. Electrical, plumbing and mechanical schemes are included, to satisfy MEP needs and ensure the successful application of all systems. Enclosure and assembly details, along with window installation plans aid greatly in the construction process, and ensure that labourers are aware of the required materials in their locations. Elevations and roof plan act as additional visual guides to the renders, allowing the audience to understand window, door, and solar panel placements, which were all done strategically to maximize solar gain and natural light. This working set of drawings utilizes the needed views, correct line weights, and ample callouts to ensure the audience is aware of the home's intent, and how it will accomplish the desired goals. Additionally, a thorough set of specifications was produced by the design team, totalling in 100+ pages of specifications to guide the construction, and ensure the completed home follows the developed design.

The energy models were created by team members who created similar models during professional internships at some of the leading building science consulting firms in Canada, employing the same knowledge, experience, and diligence as the models they created for clients. The energy models created were also reviewed by all specialized team members to ensure accuracy of all building components and mechanical systems in order to best represent the design and the final constructed building.

Due to the condensed timeline for Warrior Home specifically (the home was to be occupied by December of 2019), the project deliverables very effectively matched the final constructed home. Stages required to be discussed in the deliverables were often complete well before the progress needed to be discussed in deliverables. As such, the juries were able to receive highly accurate documentation for evaluation. Additionally, in having a condensed timeline, Warrior Home Design Team was able to receive feedback from the homeowners and witness the family's enjoyment of the home as proof of the home's success.



Engineering Innovation

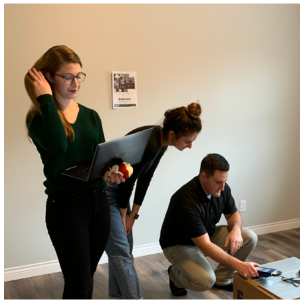
The design was heavily and extensively based on research as well as thermal modelling. Initially, the team's main focus for research was finding materials that were readily available, had better R-values, and were cost effective. Extensive research was also conducted on ways to reduce thermal bridging and promote energy efficiency. This included methods to achieve continuous insulation, different structural framing techniques, and window framing materials. Then the team set a goal R-value for both the roof and the walls using passive house standards as a starting point. The team came up with many different possible solutions, such as only using interior insulation or exterior insulation, as well as a combined system. A variety of materials and material thicknesses were experimented with to see how it would affect the R-values. Each possible solution was tested using thermal modelling software and the chosen option was based on the optimal values and most efficient use of materials and space. Research and industry knowledge were also used extensively in all other aspects of the design as the team did not have any graduate students, or technical advisors such as professor available to extensively assist in the design process. All design was determined from team member research, or personal co-op experiences.

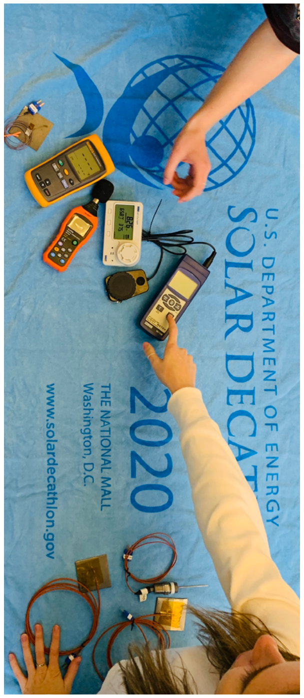
The materials involved in the design are common, but the positioning of each control layer incorporates recent research findings and techniques to prevent some of the common problems that usually occur with building enclosures. Having both interior and continuous exterior insulation is a simple solution but not one that is commonly used in the built environment. The team also used a technique that is an adaptation of the R.E.M.OT.E. wall, where most of the insulation is on the exterior of the sheathing. The point of this was to limit thermal bridging from occurring and to move the dew point to the exterior of the structural system. This removes the possibility of moisture and mold issues inside the structural system which could lead to early structural deterioration. Additionally, the Warrior Home design team made the innovative choice to implement advanced framing instead of standard framing for this build.

One of the main challenges for this design, and that which challenged the status quo, was designing a home that suited the Indigenous family occupying it, and accommodating for an occupant with visual and potential physical impairments. It was through long-term research and user-feedback surveys conducted prior to the design process that the homes floor plan and interior design could be made to closely align with Indigenous needs and values as well as the individual needs of the homeowner.

Conclusion

During the design process, the integration of all the engineering systems of the home were addressed, such as the building envelope, mechanical systems, architecture and solar, water and electrical systems. Technologies such as enhanced insulation, a raised heel roof truss, photovoltaics, efficient plumbing and HVAC systems as well as advanced structural framing techniques optimized the house's overall performance. The design team provided ample thought into the design and construction of the home, as well as the durability, longevity and maintenance plan.





We are going above and beyond to make our units more energy efficient so it translates into savings in operation and maintenance costs for our tenants.

Shane Chegahno
Housing Manager, Chippewas of Nawash

Appendix A: Energy Modelling Outputs

Note: A Tesla Model 3 Standard Plus was Selected as the Vehicle for Energy Modeling Purposes.

REPORT- LV-M DOE-2.2 Units Conversion Table WEATHER FILE- Toronto ON CWEC

	ENGLISH	MULTIPLIED BY GIVES	METRIC	MULTIPLIED BY GIVES	ENGLISH
1		1.000000		1.000000	
2		1.000000		1.000000	
3	BTU	0.293000	WH	3.412969	BTU
4	BTU/HR	0.293000	WATT	3.412969	BTU/HR
5	BTU/LB-F	4183.830078	J/KG-K	0.000239	BTU/LB-F
6	BTU/HR-SQFT-F	5.678260	W/M2-K	0.176110	BTU/HR-SQFT-F
7	DEGREES	1.000000	DEGREES	1.000000	DEGREES
9	SQFT	0.092903	M2	10.763915	SQFT
10	CUFT	0.028317	M3	35.314724	CUFT
11	LB/HR	0.453592	KG/HR	2.204624	LB/HR
12	LB/CUFT	16.018459	KG/M3	0.062428	LB/CUFT
13	MPH	0.447040	M/S	2.236936	MPH
14	BTU/HR-F	0.527178	W/K	1.896893	BTU/HR-F
15	FT	0.304800	M	3.280840	FT
16	BTU/HR-FT-F	1.730735	W/M-K	0.577789	BTU/HR-FT-F
17	BTU/HR- SQFT	3.152480	WATT /M2	0.317211	BTU/HR- SQFT
18	IN	2.540000	CM	0.393701	IN
19	UNITS/IN	0.393700	UNITS/CM	2.540005	UNITS/IN
20	UNITS	1.000000	UNITS	1.000000	UNITS
21	LB	0.453592	KG	2.204624	LB
22	FRAC.OR MULT.	1.000000	FRAC.OR MULT.	1.000000	FRAC.OR MULT.
23	HOURS	1.000000	HRS	1.000000	HOURS
24	PERCENT-RH	1.000000	PERCENT-RH	1.000000	PERCENT-RH
25	CFM	1.699010	M3/H	0.588578	CFM
26	IN-WATER	25.400000	MM-WATER	0.039370	IN-WATER
27	LB/SQFT	4.882400	KG/M2	0.204817	LB/SQFT
28	KW	1.000000	KW	1.000000	KW
29	W/SQFT	10.763920	W/M2	0.092903	W/SQFT
30	THERMS	25.000000	THERMIES	0.040000	THERMS
31	KNOTS	0.514440	M/SEC	1.943861	KNOTS
32	HR-SQFT-F /BTU	0.176228	M2-K /W	5.674467	HR-SQFT-F /BTU
33	$DOLLARS	1.000000	$DOLLARS	1.000000	$DOLLARS
34	MBTU/HR	0.293000	MWATT	3.412969	MBTU/HR
35	YEARS	1.000000	YEARS	1.000000	YEARS
36	$/HR	1.000000	$/HR	1.000000	$/HR
37	HRS/YEARS	1.000000	HRS/YEARS	1.000000	HRS/YEARS
38	PERCENT	1.000000	PERCENT	1.000000	PERCENT
39	$/MONTH	1.000000	$/MONTH	1.000000	$/MONTH
40	GALLONS/MIN/TON	1.078000	LITERS/MIN/KW	0.927644	GALLONS/MIN/TON
41	BTU/LB	0.645683	WH/KG	1.548748	BTU/LB
42	LBS/SQIN-GAGE	68.947571	MBAR-GAGE	0.014504	LBS/SQIN-GAGE
43	$/UNIT	1.000000	$/UNIT	1.000000	$/UNIT
44	BTU/HR/PERSON	0.293000	W/PERSON	3.412969	BTU/HR/PERSON
45	LBS/LB	1.000000	KGS/KG	1.000000	LBS/LB
46	BTU/BTU	1.000000	KWH/KWH	1.000000	BTU/BTU
47	LBS/KW	0.453590	KG/KW	2.204634	LBS/KW
48	REV/MIN	1.000000	REV/MIN	1.000000	REV/MIN
49	KW/TON	1.000000	KW/TON	1.000000	KW/TON
50	MBTU	0.293000	MWH	3.412969	MBTU
51	GAL	3.785410	LITER	0.264172	GAL
52	GAL/MIN	3.785410	LITERS/MIN	0.264172	GAL/MIN
53	BTU/F	1897.800049	J/K	0.000527	BTU/F
54	KWH	1.000000	KWH	1.000000	KWH
55	$/UNIT-HR	1.000000	$/UNIT-HR	1.000000	$/UNIT-HR
56	KW/CFM	0.588500	KW/M3/HR	1.699235	KW/CFM
57	BTU/SQFT-F	20428.400391	J/M2-K	0.000049	BTU/SQFT-F
58	HR/HR	1.000000	HR/HR	1.000000	HR/HR
59	BTU/FT-F	6226.479980	J/M-K	0.000161	BTU/FT-F
60	R	0.555556	K	1.799999	R

61	INCH MER	33.863800	MBAR	0.029530	INCH MER
62	UNITS/GAL/MIN	0.264170	UNITS/LITER/MIN	3.785441	UNITS/GAL/MIN
63	(HR-SQFT-F/BTU)2	0.031056	(M2-K /W)2	32.199585	(HR-SQFT-F/BTU)2
64	KBTU/HR	0.293000	KW	3.412969	KBTU/HR
65	KBTU	0.293000	KWH	3.412969	KBTU
66	CFM	0.471900	L/S	2.119093	CFM
67	CFM/SQFT	18.288000	M3/H-M2	0.054681	CFM/SQFT
68	1/R	1.799900	1/K	0.555586	1/R
69	1/KNOT	1.943860	SEC/M	0.514440	1/KNOT
70	FOOTCANDLES	10.763910	LUX	0.092903	FOOTCANDLES
71	FOOTLAMBERT	3.426259	CANDELA/M2	0.291864	FOOTLAMBERT
72	LUMEN / WATT	1.000000	LUMEN / WATT	1.000000	LUMEN / WATT
73	KBTU/SQFT-YR	3.152480	KWH/M2-YR	0.317211	KBTU/SQFT-YR
74	F (DELTA)	0.555556	C (DELTA)	1.799999	F (DELTA)
75	BTU/DAY	0.012202	WATT	81.953773	BTU/DAY
76	$/YEAR	1.000000	$/YEAR	1.000000	$/YEAR
77	BTU/WATT	0.293000	WATT/WATT	3.412969	BTU/WATT
78	RADIANS	1.000000	RADIANS	1.000000	RADIANS
79	WATT/BTU	3.413000	WATT/WATT	0.292997	WATT/BTU
80	BTU	0.000293	KWH	3412.969482	BTU
81	WATT	1.000000	WATT	1.000000	WATT
82	LUMENS	1.000000	LUMENS	1.000000	LUMENS
83	BTU/HR-FT-R2	3.115335	W/M-K2	0.320993	BTU/HR-FT-R2
84	LB/FT-S	1.488163	KG/M-S	0.671969	LB/FT-S
85	LB/FT-S-R	2.678693	KG/M-S-K	0.373316	LB/FT-S-R
86	LB/CUFT-R	28.833212	KG/M3-K	0.034682	LB/CUFT-R
87	BTU/HR-FT-R	1.730741	W/M-K	0.577787	BTU/HR-FT-R
88	THERM	2.831700	M3	0.353145	THERM
89	THERM/HR	2.831700	M3/HR	0.353145	THERM/HR
90	TON	0.907180	TONNE	1.102317	TON
91	TON/HR	0.907180	TONNE/HR	1.102317	TON/HR
92	BTU/UNIT	1.000000	BTU/UNIT	1.000000	BTU/UNIT
93	$	1.000000	$	1.000000	$
94	KW/GAL/MIN	0.264170	KW/LITER/MIN	3.785441	KW/GAL/MIN
95	CUFT/GAL	0.448831	M3-MIN/H-LITERS	2.228010	CUFT/GAL
96	MINUTES	1.000000	MINUTES	1.000000	MINUTES
97	UNUSED	1.000000	UNUSED	1.000000	UNUSED
98	UNUSED	1.000000	UNUSED	1.000000	UNUSED
99	UNUSED	1.000000	UNUSED	1.000000	UNUSED
100	UNUSED	1.000000	UNUSED	1.000000	UNUSED
101	UNUSED	1.000000	UNUSED	1.000000	UNUSED
102	UNUSED	1.000000	UNUSED	1.000000	UNUSED
103	UNUSED	1.000000	UNUSED	1.000000	UNUSED
104	UNUSED	1.000000	UNUSED	1.000000	UNUSED
105	UNUSED	1.000000	UNUSED	1.000000	UNUSED
106	UNUSED	1.000000	UNUSED	1.000000	UNUSED
107	UNUSED	1.000000	UNUSED	1.000000	UNUSED
108	UNUSED	1.000000	UNUSED	1.000000	UNUSED
109	UNUSED	1.000000	UNUSED	1.000000	UNUSED
110	UNUSED	1.000000	UNUSED	1.000000	UNUSED
111	UNUSED	1.000000	UNUSED	1.000000	UNUSED
112	UNUSED	1.000000	UNUSED	1.000000	UNUSED
113	BTU-F/BTU	0.555560	KWH-C/KWH	1.799986	BTU-F/BTU
114	UNUSED	1.000000	UNUSED	1.000000	UNUSED
115	VOLTS	1.000000	VOLTS	1.000000	VOLTS
116	C	1.000000	C	1.000000	C
117	AMPS	1.000000	AMPS	1.000000	AMPS
118	VOLTS/C	1.000000	VOLTS/C	1.000000	VOLTS/C
119	1/C	1.000000	1/C	1.000000	1/C
120	FT/MIN	0.005080	M/S	196.850388	FT/MIN
121	GAL/MIN	227.160004	LITERS/HR	0.004402	GAL/MIN
122	KW/CFM	588.500000	W/M3/HR	0.001699	KW/CFM
123	BTU/HR-F	0.000527	KW/C	1896.892578	BTU/HR-F
124	HP	0.102000	kW	9.803922	HP
125	CFM/TON	0.483200	(M3/H)/KW	2.069536	CFM/TON
126	UNUSED	1.000000	UNUSED	1.000000	UNUSED

127	UNUSED	1.000000	UNUSED	1.000000	UNUSED
128	UNUSED	1.000000	UNUSED	1.000000	UNUSED
129	UNUSED	1.000000	UNUSED	1.000000	UNUSED
130	1/VOLTS	1.000000	1/VOLTS	1.000000	1/VOLTS
131	(C-M2)/W	1.000000	(C-M2)/W	1.000000	(C-M2)/W
132	(C-M-SEC)/W	1.000000	(C-M-SEC)/W	1.000000	(C-M-SEC)/W
133	W/M2	1.000000	W/M2	1.000000	W/M2
134	TDV-MBTUH	0.293000	TDV-MW	3.412969	TDV-MBTUH
135	TDV-MBTU	0.293000	TDV-MWH	3.412969	TDV-MBTU
136	TDV-KBTU/KWH	0.293000	TDV-KWH/KWH	3.412969	TDV-KBTU/KWH
137	TDV-KBTU/THERM	0.010000	TDV-KWH/KWH	100.000000	TDV-KBTU/THERM
138	FT2/HR	0.092903	M2/SEC	10.763915	FT2/HR
139	GPM	0.063100	L/S	15.847859	GPM
140	FT/S	0.304800	M/S	3.280840	FT/S
141	HR-FT-F/BTU	0.577800	M-K/W	1.730703	HR-FT-F/BTU

REPORT- LV-N Building Coordinate Geometry WEATHER FILE- Toronto ON CWEC

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SPACE.................... (SPACE ORIGIN)
    WALL................ (VERTEX1) (VERTEX2) (...)
        WINDOW.......... (VERTEX1) (VERTEX2) (...)
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EL1 SW Perim Spc........ (    0.0      0.0      0.0)
    EL1 Flr (G.SW1.I.... (    0.0      0.0      0.0) (  -25.5     25.5      0.0) (  -21.2     29.7      0.0) (  -29.7     38.2      0.0)
                         (  -12.7     55.2      0.0) (   -4.2     46.7      0.0) (    0.0     50.9      0.0) (   25.5     25.5      0.0)
    EL1 SE Wall (G.S.... (    0.0      0.0      9.0) (    0.0      0.0      0.0) (   25.5     25.5      0.0) (   25.5     25.5      9.0)
        Window 1........ (    8.5      8.5      6.0) (    8.5      8.5      3.0) (   10.3     10.3      3.0) (   10.3     10.3      6.0)
    EL1 NE Wall (G.S.... (   25.5     25.5      9.0) (   25.5     25.5      0.0) (    0.0     50.9      0.0) (    0.0     50.9      9.0)
        Window 2........ (   23.3     27.6      7.0) (   23.3     27.6      3.0) (   20.9     30.1      3.0) (   20.9     30.1      7.0)
        Window 3........ (   17.0     33.9      7.0) (   17.0     33.9      3.0) (   14.5     36.4      3.0) (   14.5     36.4      7.0)
        Window 4........ (   11.3     39.6      6.0) (   11.3     39.6      3.0) (    9.5     41.4      3.0) (    9.5     41.4      6.0)
    EL1 NW Wall (G.S.... (    0.0     50.9      9.0) (    0.0     50.9      0.0) (   -4.2     46.7      0.0) (   -4.2     46.7      9.0)
    EL1 NE Wall (G.S.... (   -4.2     46.7      9.0) (   -4.2     46.7      0.0) (  -12.7     55.2      0.0) (  -12.7     55.2      9.0)
        Window 5........ (   -7.1     49.5      6.5) (   -7.1     49.5      3.0) (   -9.2     51.6      3.0) (   -9.2     51.6      6.5)
    EL1 NW Wall (G.S.... (  -12.7     55.2      9.0) (  -12.7     55.2      0.0) (  -29.7     38.2      0.0) (  -29.7     38.2      9.0)
        Window 6........ (  -19.8     48.1      9.0) (  -19.8     48.1      3.0) (  -23.0     44.9      3.0) (  -23.0     44.9      9.0)
    EL1 SW Wall (G.S.... (  -29.7     38.2      9.0) (  -29.7     38.2      0.0) (  -21.2     29.7      0.0) (  -21.2     29.7      9.0)
        Window 7........ (  -26.9     35.4      6.5) (  -26.9     35.4      3.0) (  -22.6     31.1      3.0) (  -22.6     31.1      6.5)
    EL1 NW Wall (G.S.... (  -21.2     29.7      9.0) (  -21.2     29.7      0.0) (  -25.5     25.5      0.0) (  -25.5     25.5      9.0)
    EL1 SW Wall (G.S.... (  -25.5     25.5      9.0) (  -25.5     25.5      0.0) (    0.0      0.0      0.0) (    0.0      0.0      9.0)
        Window 8........ (  -22.6     22.6      6.5) (  -22.6     22.6      3.0) (  -19.8     19.8      3.0) (  -19.8     19.8      6.5)
        Window 9........ (  -15.6     15.6      6.5) (  -15.6     15.6      3.0) (  -12.7     12.7      3.0) (  -12.7     12.7      6.5)
    EL1 Roof............ (    0.0      0.0      9.0) (   25.5     25.5      9.0) (    0.0     50.9      9.0) (   -4.2     46.7      9.0)
                         (  -12.7     55.2      9.0) (  -29.7     38.2      9.0) (  -21.2     29.7      9.0) (  -25.5     25.5      9.0)
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REPORT- LV-A General Project Parameters WEATHER FILE- Toronto ON CWEC

PERIOD OF STUDY

STARTING DATE	ENDING DATE	NUMBER OF DAYS
1 JAN 2019	31 DEC 2019	365

SITE CHARACTERISTIC DATA

STATION NAME	LATITUDE (DEG)	LONGITUDE (DEG)	ALTITUDE (FT)	TIME ZONE	BUILDING AZIMUTH (DEG)
Toronto ON CWEC	43.7	79.4	1362.	5 EST	0.0

REPORT- LV-B Summary of Spaces WEATHER FILE- Toronto ON CWEC

NUMBER OF SPACES 1 EXTERIOR 1 INTERIOR 0

SPACE	SPACE*FLOOR MULTIPLIER	SPACE TYPE	AZIM	LIGHTS (WATT / SQFT)	PEOPLE	EQUIP (WATT / SQFT)	INFILTRATION METHOD	ACH	AREA (SQFT)	VOLUME (CUFT)
Spaces on floor: EL1 Ground Flr										
EL1 SW Perim Spc (G.SW1)	1.0	EXT	0.0	0.68	5.2	0.44	AIR-CHANGE	0.24	1584.0	14256.0
					------				---------	----------
BUILDING TOTALS					5.2				1584.0	14256.0

REPORT- LV-C Details of Space EL1 SW Perim Spc (G.SW1) WEATHER FILE- Toronto ON CWEC

DATA FOR SPACE EL1 SW Perim Spc (G.SW1) IN FLOOR EL1 Ground Flr

LOCATION OF ORIGIN IN BUILDING COORDINATES

XB (FT)	YB (FT)	ZB (FT)	SPACE AZIMUTH (DEG)	SPACE*FLOOR MULTIPLIER	HEIGHT (FT)	AREA (SQFT)	VOLUME (CUFT)
0.00	0.00	0.00	0.00	1.0	9.00	1584.00	14256.00

TOTAL NUMBER OF SURFACES	NUMBER OF EXTERIOR SURFACES	NUMBER OF INTERIOR SURFACES	NUMBER OF UNDERGROUND SURFACES	DAYLIGHTING	SUNSPACE
10	10	0	0	NO	NO

NUMBER OF SUBSURFACES

TOTAL	EXTERIOR WINDOWS	DOORS	INTERIOR WINDOWS
11	9	2	0

FLOOR WEIGHT (LB/SQFT)	CALCULATION TEMPERATURE (F)
0.0	70.0

INFILTRATION

SCHEDULE	INFILTRATION CALCULATION METHOD	FLOW RATE (CFM/SQFT)	AIR CHANGES PER HOUR
ZG0-S1 (PTAC) P-Inf Sch	AIR-CHANGE	0.036	0.24

PEOPLE

SCHEDULE	NUMBER	AREA PER PERSON (SQFT)	PEOPLE SENSIBLE (BTU/HR)	PEOPLE LATENT (BTU/HR)
EL1 Bldg Occup Sch	5.2	307.2	245.0	155.0

LIGHTING

SCHEDULE	LIGHTING TYPE	LOAD (WATTS/ SQFT)	LOAD (KW)	FRACTION OF LOAD TO SPACE
EL1 Bldg InsLt Sch	SUS-FLUOR	0.68	1.08	1.00

ELECTRICAL EQUIPMENT

SCHEDULE	ELEC LOAD (WATTS/ SQFT)	ELEC LOAD (KW)	FRACTION OF LOAD TO SPACE SENSIBLE	LATENT
Annual Equip Schedule	0.44	0.70	1.00	0.00

EXTERIOR SURFACES (U-VALUE EXCLUDES OUTSIDE AIR FILM)

SURFACE	MULTIPLIER	AREA (SQFT)	CONSTRUCTION	U-VALUE (BTU/HR-SQFT-F)	SURFACE TYPE
EL1 Flr (G.SW1.I1)	1.0	1584.00	WHFoundation	0.057	DELAYED
EL1 SE Wall (G.SW1.E1)	1.0	324.00	WH_AGWalls	0.027	DELAYED
EL1 NE Wall (G.SW1.E2)	1.0	324.00	WH_AGWalls	0.027	DELAYED
EL1 NW Wall (G.SW1.E3)	1.0	54.00	WH_AGWalls	0.027	DELAYED
EL1 NE Wall (G.SW1.E4)	1.0	108.00	WH_AGWalls	0.027	DELAYED
EL1 NW Wall (G.SW1.E5)	1.0	216.00	WH_AGWalls	0.027	DELAYED
EL1 SW Wall (G.SW1.E6)	1.0	108.00	WH_AGWalls	0.027	DELAYED
EL1 NW Wall (G.SW1.E7)	1.0	54.00	WH_AGWalls	0.027	DELAYED
EL1 SW Wall (G.SW1.E8)	1.0	324.00	WH_AGWalls	0.027	DELAYED
EL1 Roof	1.0	1584.00	WHRoof	0.016	DELAYED

SURFACE	AZIMUTH (DEG)	TILT (DEG)	LOCATION OF ORIGIN IN BUILDING COORDINATES XB (FT)	YB (FT)	ZB (FT)	LOCATION OF ORIGIN IN SPACE COORDINATES X (FT)	Y (FT)	Z (FT)
EL1 Flr (G.SW1.I1)	90.0	180.0	-25.46	25.46	0.00	0.00	0.00	0.00
EL1 SE Wall (G.SW1.E1)	-180.0	90.0	0.00	0.00	0.00	0.00	0.00	0.00
EL1 NE Wall (G.SW1.E2)	-270.0	90.0	25.46	25.46	0.00	36.00	0.00	0.00
EL1 NW Wall (G.SW1.E3)	0.0	90.0	0.00	50.91	0.00	36.00	36.00	0.00
EL1 NE Wall (G.SW1.E4)	-270.0	90.0	-4.24	46.67	0.00	30.00	36.00	0.00
EL1 NW Wall (G.SW1.E5)	0.0	90.0	-12.73	55.15	0.00	30.00	48.00	0.00
EL1 SW Wall (G.SW1.E6)	-90.0	90.0	-29.70	38.18	0.00	6.00	48.00	0.00
EL1 NW Wall (G.SW1.E7)	0.0	90.0	-21.21	29.70	0.00	6.00	36.00	0.00
EL1 SW Wall (G.SW1.E8)	-90.0	90.0	-25.46	25.46	0.00	0.00	36.00	0.00
EL1 Roof	180.0	0.0	25.46	25.46	9.00	0.00	0.00	9.00

EXTERIOR WINDOWS (U-VALUE INCLUDES OUTSIDE AIR FILM)

WINDOW	MULTIPLIER	GLASS AREA (SQFT)	GLASS WIDTH (FT)	GLASS HEIGHT (FT)	SET-BACK (FT)	NUMBER OF PANES	CENTER-OF-GLASS U-VALUE (BTU/HR-SQFT-F)	GLASS SHADING COEFF	GLASS VISIBLE TRANS	GLASS SOLAR TRANS
Window 1	1.0	7.50	2.50	3.00	0.00	1	0.233	0.22	0.900	0.878
Window 2	1.0	14.00	3.50	4.00	0.00	1	0.233	0.22	0.900	0.878
Window 3	1.0	14.00	3.50	4.00	0.00	1	0.233	0.22	0.900	0.878
Window 4	1.0	7.50	2.50	3.00	0.00	1	0.233	0.22	0.900	0.878
Window 5	1.0	10.50	3.00	3.50	0.00	1	0.233	0.22	0.900	0.878
Window 6	1.0	27.00	4.50	6.00	0.00	1	0.233	0.22	0.900	0.878
Window 7	1.0	21.00	6.00	3.50	0.00	1	0.233	0.22	0.900	0.878
Window 8	1.0	14.00	4.00	3.50	0.00	1	0.233	0.22	0.900	0.878
Window 9	1.0	14.00	4.00	3.50	0.00	1	0.233	0.22	0.900	0.878

		LOCATION OF ORIGIN IN BUILDING COORDINATES			LOCATION OF ORIGIN IN SURFACE COORDINATES	
WINDOW	LOCATED IN SURFACE	XB (FT)	YB (FT)	ZB (FT)	X (FT)	Y (FT)
Window 1	EL1 SE Wall (G.SW1.E1)	8.49	8.49	3.00	12.00	3.00
Window 2	EL1 NE Wall (G.SW1.E2)	23.33	27.58	3.00	3.00	3.00
Window 3	EL1 NE Wall (G.SW1.E2)	16.97	33.94	3.00	12.00	3.00
Window 4	EL1 NE Wall (G.SW1.E2)	11.31	39.60	3.00	20.00	3.00
Window 5	EL1 NE Wall (G.SW1.E4)	-7.07	49.50	3.00	4.00	3.00
Window 6	EL1 NW Wall (G.SW1.E5)	-19.80	48.08	3.00	10.00	3.00
Window 7	EL1 SW Wall (G.SW1.E6)	-26.87	35.36	3.00	4.00	3.00
Window 8	EL1 SW Wall (G.SW1.E8)	-22.63	22.63	3.00	4.00	3.00
Window 9	EL1 SW Wall (G.SW1.E8)	-15.56	15.56	3.00	14.00	3.00

REPORT- LV-D Details of Exterior Surfaces WEATHER FILE- Toronto ON CWEC

NUMBER OF EXTERIOR SURFACES 10
(U-VALUE INCLUDES OUTSIDE FILM; WINDOW INCLUDES FRAME AND CURB, IF DEFINED)

	- - - W I N D O W S - - -		- - - - W A L L - - - -		-W A L L + W I N D O W S-		
SURFACE	U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	U-VALUE (BTU/HR-SQFT-F)	AREA (SQFT)	AZIMUTH
EL1 NE Wall (G.SW1.E2) in space: EL1 SW Perim Spc (G.SW1)	0.233	35.50	0.027	288.50	0.049	324.00	NORTH-EAST
EL1 NE Wall (G.SW1.E4) in space: EL1 SW Perim Spc (G.SW1)	0.233	10.50	0.027	97.50	0.047	108.00	NORTH-EAST
EL1 SE Wall (G.SW1.E1) in space: EL1 SW Perim Spc (G.SW1)	0.233	7.50	0.027	316.50	0.032	324.00	SOUTH-EAST
EL1 SW Wall (G.SW1.E6) in space: EL1 SW Perim Spc (G.SW1)	0.233	21.00	0.027	87.00	0.067	108.00	SOUTH-WEST
EL1 SW Wall (G.SW1.E8) in space: EL1 SW Perim Spc (G.SW1)	0.233	28.00	0.027	296.00	0.045	324.00	SOUTH-WEST
EL1 NW Wall (G.SW1.E3) in space: EL1 SW Perim Spc (G.SW1)	0.000	0.00	0.027	54.00	0.027	54.00	NORTH-WEST
EL1 NW Wall (G.SW1.E7) in space: EL1 SW Perim Spc (G.SW1)	0.000	0.00	0.027	54.00	0.027	54.00	NORTH-WEST
EL1 NW Wall (G.SW1.E5) in space: EL1 SW Perim Spc (G.SW1)	0.233	27.00	0.027	189.00	0.053	216.00	NORTH-WEST
EL1 Flr (G.SW1.I1) in space: EL1 SW Perim Spc (G.SW1)	0.000	0.00	0.056	1584.00	0.056	1584.00	FLOOR
EL1 Roof in space: EL1 SW Perim Spc (G.SW1)	0.000	0.00	0.016	1584.00	0.016	1584.00	ROOF

REPORT- LV-D Details of Exterior Surfaces WEATHER FILE- Toronto ON CWEC

(CONTINUED)

	AVERAGE U-VALUE/WINDOWS (BTU/HR-SQFT-F)	AVERAGE U-VALUE/WALLS (BTU/HR-SQFT-F)	AVERAGE U-VALUE WALLS+WINDOWS (BTU/HR-SQFT-F)	WINDOW AREA (SQFT)	WALL AREA (SQFT)	WINDOW+WALL AREA (SQFT)
NORTH-EAST	0.233	0.027	0.049	46.00	386.00	432.00
SOUTH-EAST	0.233	0.027	0.032	7.50	316.50	324.00
SOUTH-WEST	0.233	0.027	0.050	49.00	383.00	432.00
NORTH-WEST	0.233	0.027	0.044	27.00	297.00	324.00
FLOOR	0.000	0.056	0.056	0.00	1584.00	1584.00
ROOF	0.000	0.016	0.016	0.00	1584.00	1584.00
ALL WALLS	0.233	0.027	0.044	129.50	1382.50	1512.00
WALLS+ROOFS	0.233	0.021	0.030	129.50	2966.50	3096.00
BUILDING	0.233	0.033	0.039	129.50	4550.50	4680.00

REPORT- LV-E Details of Underground Surfaces WEATHER FILE- Toronto ON CWEC

NUMBER OF UNDERGROUND SURFACES 0

REPORT- LV-F Details of Interior Surfaces WEATHER FILE- Toronto ON CWEC

Number of Interior Surfaces 0
(U-VALUE includes both air films)

NUMBER OF SCHEDULES 15

Schedule: EL1 Bldg Occup Sch Type of Schedule: FRACTION

THROUGH 31 12

FOR DAYS SUN SAT HOL CDD

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.85	0.70	0.53	0.50	0.50	0.50	0.50	0.53	0.70	0.85	0.90	0.90	0.90	0.90	0.90	0.90	0.90

FOR DAYS MON TUE WED THU FRI

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.90	0.90	0.90	0.90	0.90	0.90	0.70	0.40	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.50	0.90	0.90	0.90	0.90	0.90	0.90	0.90

FOR DAYS HDD

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Schedule: EL1 Bldg InsLt Sch Type of Schedule: FRACTION

THROUGH 31 12

FOR DAYS SUN SAT HOL CDD

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.11	0.01	0.00	0.00	0.00	0.02	0.12	0.31	0.48	0.43	0.07	0.00	0.00	0.00	0.00	0.00	0.13	0.77	0.90	0.89	0.85	0.74	0.57	0.34

FOR DAYS MON TUE WED THU FRI

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.00	0.00	0.00	0.00	0.00	0.20	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.90	0.90	0.90	0.80	0.60	0.30

FOR DAYS HDD

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Schedule: EL1 Bldg SCRfg Sch Type of Schedule: FRACTION

THROUGH 31 12

FOR DAYS SUN HOL

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.68	0.66	0.64	0.64	0.64	0.64	0.65	0.66	0.71	0.75	0.80	0.81	0.83	0.83	0.83	0.83	0.81	0.81	0.80	0.80	0.77	0.74	0.71	0.68

FOR DAYS MON TUE WED THU FRI CDD

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.70	0.67	0.64	0.64	0.64	0.64	0.66	0.67	0.73	0.79	0.86	0.88	0.90	0.90	0.90	0.90	0.88	0.87	0.86	0.86	0.82	0.78	0.73	0.70

FOR DAYS SAT

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.69	0.67	0.64	0.64	0.64	0.64	0.65	0.67	0.72	0.76	0.82	0.84	0.86	0.86	0.86	0.86	0.84	0.83	0.82	0.82	0.79	0.75	0.72	0.69

FOR DAYS HDD

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Schedule: EL1 Bldg Cook Sch Type of Schedule: FRACTION

THROUGH 31 12

FOR DAYS SUN HOL CDD

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.00	0.00	0.00	0.00	0.02	0.03	0.05	0.10	0.25	0.20	0.10	0.12	0.16	0.10	0.05	0.25	0.40	0.70	0.40	0.20	0.08	0.02	0.01	0.01

FOR DAYS MON TUE WED THU FRI

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.00	0.00	0.00	0.00	0.10	0.20	0.15	0.10	0.05	0.01	0.05	0.08	0.12	0.07	0.02	0.15	0.30	0.50	0.30	0.12	0.06	0.02	0.01	0.01

FOR DAYS SAT

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.00	0.00	0.00	0.00	0.02	0.03	0.05	0.10	0.25	0.15	0.05	0.12	0.16	0.10	0.05	0.20	0.35	0.70	0.40	0.24	0.10	0.05	0.02	0.02

FOR DAYS HDD

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Schedule: DHW Eqp Res Sch Type of Schedule: FRACTION

THROUGH 31 12

FOR DAYS SUN HOL

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.08	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.09	0.20	0.27	0.23	0.30	0.43	0.57	0.65	0.47	0.34	0.25	0.21	0.20	0.20	0.19	0.14

FOR DAYS MON TUE WED THU FRI

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.05	0.05	0.05	0.05	0.05	0.20	0.80	0.70	0.50	0.40	0.20	0.20	0.20	0.30	0.50	0.50	0.70	0.70	0.40	0.40	0.20	0.20	0.10	0.10

FOR DAYS SAT CDD

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.08	0.05	0.05	0.05	0.05	0.05	0.06	0.12	0.27	0.47	0.47	0.33	0.32	0.47	0.76	0.72	0.69	0.63	0.55	0.47	0.38	0.30	0.22	0.14

FOR DAYS HDD

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Schedule: ZG0-S1 (PTAC) P-Inf Sch Type of Schedule: MULTIPLIER

THROUGH 31 12

FOR DAYS SUN SAT HOL CDD

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.50	0.50	0.50	0.50	0.50	0.50	0.51	0.95	1.25	1.14	1.00	1.00	1.00	1.00	1.14	1.25	0.95	0.51	0.50	0.50	0.50	0.50	0.50	0.50

FOR DAYS MON TUE WED THU FRI

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.50	0.50	0.50	0.50	0.50	0.94	1.25	1.25	1.05	1.00	1.00	1.00	1.00	1.00	1.00	1.15	1.25	1.25	0.50	0.50	0.50	0.50	0.50	0.50

FOR DAYS HDD

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50

Schedule: ZG0-S1 (PTAC) C-Inf Sch Type of Schedule: FRACTION

THROUGH 31 12

FOR DAYS SUN SAT HOL HDD CDD

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50

FOR DAYS MON TUE WED THU FRI

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.50	0.50	0.50	0.50	0.50	0.50	0.50	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.50	0.50	0.50	0.50	0.50	0.50	0.50

Schedule: S1 Sys1 (PTAC) Fan Sch Type of Schedule: ON/OFF/FLAG

THROUGH 31 12

FOR DAYS SUN SAT HOL HDD CDD

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	1.	1.	1.	1.	1.	1.	1.	1.	1.	0.	0.	0.	0.	0.	0.	0.	1.	1.	1.	1.	1.	1.	1.	1.

FOR DAYS MON TUE WED THU FRI

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	1.	1.	1.	1.	1.	1.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	1.	1.	1.	1.	1.	1.

Schedule: S1 Sys1 (PTAC) Cool Sch Type of Schedule: TEMPERATURE

THROUGH 31 12

FOR DAYS SUN SAT HOL HDD CDD

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0

FOR DAYS MON TUE WED THU FRI

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	78.0	78.0	78.0	78.0	78.0	78.0	78.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	78.0	78.0	78.0	78.0	78.0	78.0	78.0

Schedule: S1 Sys1 (PTAC) Heat Sch Type of Schedule: TEMPERATURE

THROUGH 31 12

FOR DAYS SUN SAT HOL HDD CDD

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0

FOR DAYS MON TUE WED THU FRI

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	71.0	71.0	71.0	71.0	71.0	71.0	71.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0

Schedule: Schedule ON/OFF Type of Schedule: ON/OFF

THROUGH 31 12

FOR DAYS SUN MON TUE WED THU FRI SAT HOL

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.

Schedule: ERV Schedule Type of Schedule: ON/OFF

THROUGH 31 12

FOR DAYS SUN TUE WED THU FRI SAT HOL HDD

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	1.	1.	1.	0.	1.	1.	1.	0.	1.	1.	1.	0.	1.	1.	1.	0.	1.	1.	1.	0.	1.	1.	1.	0.

FOR DAYS MON

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.

Schedule: Annual Equip Schedule Type of Schedule: FRACTION

THROUGH 31 12

FOR DAYS SUN MON TUE WED THU FRI SAT HOL

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	0.20	0.20	0.20	0.20	0.20	0.20	0.80	0.80	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.50	0.20	0.90	0.90	0.70	0.50	0.50	0.50	0.30

Schedule: Hourly Report Schedule Type of Schedule: ON/OFF

THROUGH 31 12

FOR DAYS SUN MON TUE WED THU FRI SAT HOL

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.

Schedule: Dirt Depre Windows Type of Schedule: FRACTION

THROUGH 31 12

FOR DAYS SUN MON TUE WED THU FRI SAT HOL

HOUR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

REPORT- LV-H Details of Windows WEATHER FILE- Toronto ON CWEC

NUMBER OF WINDOWS 9

(Note: u-values include outside air film)

WINDOW NAME	MULTIPLIER	GLASS AREA (SQFT)	GLASS HEIGHT (FT)	GLASS WIDTH (FT)	LOCATION OF ORIGIN IN SURFACE COORDINATES X (FT)	Y (FT)	FRAME AREA (SQFT)	CURB AREA (SQFT)	FRAME U-VALUE (BTU/HR-SQFT-F)	CURB U-VALUE (BTU/HR-SQFT-F)
Window 1	1.0	7.50	3.00	2.50	12.00	3.00	0.00	0.00	0.384	0.000
Window 2	1.0	14.00	4.00	3.50	3.00	3.00	0.00	0.00	0.384	0.000
Window 3	1.0	14.00	4.00	3.50	12.00	3.00	0.00	0.00	0.384	0.000
Window 4	1.0	7.50	3.00	2.50	20.00	3.00	0.00	0.00	0.384	0.000
Window 5	1.0	10.50	3.50	3.00	4.00	3.00	0.00	0.00	0.384	0.000
Window 6	1.0	27.00	6.00	4.50	10.00	3.00	0.00	0.00	0.384	0.000
Window 7	1.0	21.00	3.50	6.00	4.00	3.00	0.00	0.00	0.384	0.000
Window 8	1.0	14.00	3.50	4.00	4.00	3.00	0.00	0.00	0.384	0.000
Window 9	1.0	14.00	3.50	4.00	14.00	3.00	0.00	0.00	0.384	0.000

WINDOW NAME	SETBACK (FT)	GLASS SHADING COEFF	NUMBER OF PANES	CENTER-OF-GLASS U-VALUE (BTU/HR-SQFT-F)	GLASS VISIBLE TRANS	GLASS SOLAR TRANS	SURFACE TO ROUGH OPEN AREA RATIO
Window 1	0.00	0.22	1	0.233	0.900	0.878	1.000
Window 2	0.00	0.22	1	0.233	0.900	0.878	1.000
Window 3	0.00	0.22	1	0.233	0.900	0.878	1.000
Window 4	0.00	0.22	1	0.233	0.900	0.878	1.000
Window 5	0.00	0.22	1	0.233	0.900	0.878	1.000
Window 6	0.00	0.22	1	0.233	0.900	0.878	1.000
Window 7	0.00	0.22	1	0.233	0.900	0.878	1.000
Window 8	0.00	0.22	1	0.233	0.900	0.878	1.000
Window 9	0.00	0.22	1	0.233	0.900	0.878	1.000

REPORT- LV-I Details of Constructions WEATHER FILE- Toronto ON CWEC

NUMBER OF CONSTRUCTIONS 10 DELAYED 8 QUICK 2

CONSTRUCTION NAME	U-VALUE (BTU/HR-SQFT-F)	SURFACE ABSORPTANCE	SURFACE ROUGHNESS INDEX	SURFACE TYPE	NUMBER OF RESPONSE FACTORS
WHRoof	0.016	0.70	3	DELAYED	6
WH_AGWalls	0.027	0.70	3	DELAYED	8
WHFoundation	0.057	0.70	3	DELAYED	6
EL1 Roof Construction	0.475	0.60	1	DELAYED	4
EL1 Ceilg Construction	0.805	0.70	3	DELAYED	4
EL1 IWall Construction	0.402	0.70	3	DELAYED	4
EL1 IFlr Construction	0.249	0.70	3	DELAYED	4
EL1 GFlr Construction	2.621	0.70	3	QUICK	0
EL1 AFlr Construction	0.032	0.70	3	DELAYED	4
Dbl Lyr Unins Mtl Door	0.820	0.70	3	QUICK	0

REPORT- LV-J Details of Building Shades WEATHER FILE- Toronto ON CWEC

NUMBER OF BUILDING SHADES 8 RECTANGULAR 0 OTHER 8

RECTANGULAR SHADES

SHADE NAME	TRANSMITTANCE	HEIGHT (FT)	WIDTH (FT)	AZIMUTH (DEG)	TILT (DEG)	LOCATION OF ORIGIN BUILDING COORDINATES XB (FT)	YB (FT)	ZB (FT)

REPORT- LS-A Space Peak Loads Summary WEATHER FILE- Toronto ON CWEC

SPACE NAME	MULTIPLIER SPACE	MULTIPLIER FLOOR	COOLING LOAD (KBTU/HR)	TIME OF PEAK	DRY-BULB	WET-BULB	HEATING LOAD (KBTU/HR)	TIME OF PEAK	DRY-BULB	WET-BULB
EL1 SW Perim Spc (G.SW1)	1.	1.	12.751	JUL 7 7 PM	86.F	74.F	-15.442	JAN 1 9 AM	-1.F	-2.F
SUM			12.751				-15.442			
BUILDING PEAK			12.751	JUL 7 7 PM	86.F	74.F	-15.442	JAN 1 9 AM	-1.F	-2.F

SPACE EL1 SW Perim Spc (G.SW1)
SPACE TEMPERATURE USED FOR THE LOADS CALCULATION IS 70 F / 21 C

MULTIPLIER 1.0 FLOOR MULTIPLIER 1.0

FLOOR AREA 1584 SQFT 147 M2
VOLUME 14256 CUFT 404 M3

	COOLING LOAD		HEATING LOAD	
TIME	JUL 7 7PM		JAN 1 9AM	
DRY-BULB TEMP	86 F	30 C	-1 F	-18 C
WET-BULB TEMP	74 F	23 C	-2 F	-19 C
TOT HORIZONTAL SOLAR RAD	108 BTU/H.SQFT	340 W/M2	13 BTU/H.SQFT	40 W/M2
WINDSPEED AT SPACE	4.6 KTS	2.4 M/S	8.5 KTS	4.4 M/S
CLOUD AMOUNT 0(CLEAR)-10	1		2	

	SENSIBLE		LATENT		SENSIBLE	
	(KBTU/H)	(KW)	(KBTU/H)	(KW)	(KBTU/H)	(KW)
WALL CONDUCTION	3.042	0.891	0.000	0.000	-8.188	-2.399
ROOF CONDUCTION	1.161	0.340	0.000	0.000	-1.763	-0.517
WINDOW GLASS+FRM COND	0.339	0.099	0.000	0.000	-2.022	-0.592
WINDOW GLASS SOLAR	1.803	0.528	0.000	0.000	0.104	0.030
DOOR CONDUCTION	0.720	0.211	0.000	0.000	-1.516	-0.444
INTERNAL SURFACE COND	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURF COND	0.000	0.000	0.000	0.000	0.000	0.000
OCCUPANTS TO SPACE	0.999	0.293	0.719	0.211	0.924	0.271
LIGHT TO SPACE	2.272	0.666	0.000	0.000	1.300	0.381
EQUIPMENT TO SPACE	1.938	0.568	0.000	0.000	0.973	0.285
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	0.477	0.140	0.878	0.257	-5.253	-1.539
TOTAL	12.751	3.736	1.598	0.468	-15.442	-4.524
TOTAL / AREA	0.008	0.025	0.001	0.003	-0.010	-0.031

	COOLING		HEATING	
TOTAL LOAD	14.348 KBTU/H	4.204 KW	-15.442 KBTU/H	-4.524 KW
TOTAL LOAD / AREA	9.06 BTU/H.SQFT	28.568 W/M2	9.748 BTU/H.SQFT	30.745 W/M2

```
*****************************************************************
*                                                               *
*  NOTE  1)THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR      *
*  ----    LOADS                                                *
*        2)TIMES GIVEN IN STANDARD TIME FOR THE LOCATION        *
*          IN CONSIDERATION                                     *
*        3)THE ABOVE LOADS ARE CALCULATED ASSUMING A            *
*          CONSTANT INDOOR SPACE TEMPERATURE                    *
*                                                               *
*****************************************************************
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REPORT- LS-C BuiLding Peak Load Components WEATHER FILE- Toronto ON CWEC

*** BUILDING ***

FLOOR AREA	1584	SQFT	147	M2
VOLUME	14256	CUFT	404	M3

	COOLING LOAD		HEATING LOAD	
TIME	JUL 7 7PM		JAN 1 9AM	
DRY-BULB TEMP	86 F	30 C	-1 F	-18 C
WET-BULB TEMP	74 F	23 C	-2 F	-19 C
TOT HORIZONTAL SOLAR RAD	108 BTU/H.SQFT	340 W/M2	13 BTU/H.SQFT	40 W/M2
WINDSPEED AT SPACE	4.6 KTS	2.4 M/S	8.5 KTS	4.4 M/S
CLOUD AMOUNT 0(CLEAR)-10	1		2	

	COOLING SENSIBLE (KBTU/H)	COOLING SENSIBLE (KW)	LATENT (KBTU/H)	LATENT (KW)	HEATING SENSIBLE (KBTU/H)	HEATING SENSIBLE (KW)
WALL CONDUCTION	3.042	0.891	0.000	0.000	-8.188	-2.399
ROOF CONDUCTION	1.161	0.340	0.000	0.000	-1.763	-0.517
WINDOW GLASS+FRM COND	0.339	0.099	0.000	0.000	-2.022	-0.592
WINDOW GLASS SOLAR	1.803	0.528	0.000	0.000	0.104	0.030
DOOR CONDUCTION	0.720	0.211	0.000	0.000	-1.516	-0.444
INTERNAL SURFACE COND	0.000	0.000	0.000	0.000	0.000	0.000
UNDERGROUND SURF COND	0.000	0.000	0.000	0.000	0.000	0.000
OCCUPANTS TO SPACE	0.999	0.293	0.719	0.211	0.924	0.271
LIGHT TO SPACE	2.272	0.666	0.000	0.000	1.300	0.381
EQUIPMENT TO SPACE	1.938	0.568	0.000	0.000	0.973	0.285
PROCESS TO SPACE	0.000	0.000	0.000	0.000	0.000	0.000
INFILTRATION	0.477	0.140	0.878	0.257	-5.253	-1.539
TOTAL	12.751	3.736	1.598	0.468	-15.442	-4.524
TOTAL / AREA	0.008	0.025	0.001	0.003	-0.010	-0.031

	COOLING		HEATING	
TOTAL LOAD	14.348 KBTU/H	4.204 KW	-15.442 KBTU/H	-4.524 KW
TOTAL LOAD / AREA	9.06 BTU/H.SQFT	28.568 W/M2	9.748 BTU/H.SQFT	30.745 W/M2

```
*****************************************************************
*                                                               *
*  NOTE  1)THE ABOVE LOADS EXCLUDE OUTSIDE VENTILATION AIR      *
*  ----    LOADS                                                *
*        2)TIMES GIVEN IN STANDARD TIME FOR THE LOCATION        *
*          IN CONSIDERATION                                     *
*        3)THE ABOVE LOADS ARE CALCULATED ASSUMING A            *
*          CONSTANT INDOOR SPACE TEMPERATURE                    *
*                                                               *
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REPORT- LS-D Building Monthly Loads Summary WEATHER FILE- Toronto ON CWEC

	- - - C O O L I N G - - -						- - - H E A T I N G - - -						- - - E L E C - - -	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000	0	0	0.F	0.F	0.000	-6.172	1	9	-1.F	-2.F	-15.442	429.	1.597
FEB	0.00152	10	18	47.F	44.F	0.843	-5.414	4	9	5.F	4.F	-14.697	387.	1.597
MAR	0.02367	24	18	61.F	51.F	4.221	-4.245	11	8	6.F	6.F	-12.931	428.	1.597
APR	0.29745	17	18	76.F	59.F	8.239	-2.211	4	8	17.F	15.F	-10.769	413.	1.597
MAY	1.11448	31	18	74.F	61.F	8.747	-0.792	10	16	37.F	37.F	-6.587	427.	1.597
JUN	2.42219	9	18	82.F	65.F	11.572	-0.161	20	5	42.F	41.F	-4.206	415.	1.597
JUL	3.37659	7	18	86.F	74.F	12.751	-0.032	22	5	47.F	46.F	-2.365	427.	1.597
AUG	3.06518	3	17	87.F	67.F	11.849	-0.045	8	5	45.F	44.F	-3.011	427.	1.597
SEP	1.50173	2	18	78.F	62.F	10.603	-0.386	26	5	33.F	32.F	-5.614	415.	1.597
OCT	0.37182	10	18	71.F	58.F	6.139	-1.750	23	8	18.F	17.F	-10.581	427.	1.597
NOV	0.04993	2	18	57.F	56.F	3.207	-3.181	13	6	20.F	19.F	-9.815	417.	1.597
DEC	0.00370	4	20	55.F	54.F	0.899	-5.283	16	9	11.F	10.F	-13.482	429.	1.597
TOTAL	12.228						-29.673						5042.	
MAX						12.751						-15.442		1.597

REPORT- LS-E Space Monthly Load Components EL1 SW Perim Spc (G.SW1) WEATHER FILE- Toronto ON CWEC

(UNITS=MBTU)		WALLS	ROOFS	INT SUR	UND SUR	INFIL	WIN CON	WIN SOL	OCCUP	LIGHTS	EQUIP	SOURCE	TOTAL
	HEATNG	-4.873	-0.857	0.000	0.000	-1.684	-1.029	0.234	0.622	0.650	0.765	0.000	-6.172
JAN	SEN CL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	LAT CL					0.000			0.000		0.000	0.000	0.000
	HEATNG	-4.337	-0.746	0.000	0.000	-1.513	-0.928	0.281	0.559	0.583	0.688	0.000	-5.414
FEB	SEN CL	-0.006	-0.001	0.000	0.000	-0.001	-0.001	0.002	0.002	0.004	0.004	0.000	0.002
	LAT CL					0.000			0.001		0.000	0.000	0.001
	HEATNG	-3.761	-0.615	0.000	0.000	-1.348	-0.834	0.349	0.606	0.619	0.740	0.000	-4.245
MAR	SEN CL	-0.041	-0.003	0.000	0.000	-0.012	-0.012	0.020	0.016	0.030	0.026	0.000	0.024
	LAT CL					0.000			0.011		0.000	0.000	0.011
	HEATNG	-2.235	-0.352	0.000	0.000	-0.847	-0.516	0.299	0.472	0.415	0.554	0.000	-2.211
APR	SEN CL	-0.210	-0.004	0.000	0.000	-0.084	-0.073	0.151	0.123	0.207	0.187	0.000	0.297
	LAT CL					0.002			0.088		0.000	0.000	0.090
	HEATNG	-0.968	-0.172	0.000	0.000	-0.387	-0.246	0.173	0.300	0.208	0.302	0.000	-0.792
MAY	SEN CL	-0.269	0.073	0.000	0.000	-0.160	-0.138	0.389	0.318	0.438	0.464	0.000	1.114
	LAT CL					0.025			0.218		0.000	0.000	0.243
	HEATNG	-0.252	-0.054	0.000	0.000	-0.106	-0.072	0.051	0.113	0.066	0.093	0.000	-0.161
JUN	SEN CL	0.171	0.174	0.000	0.000	-0.066	-0.094	0.536	0.489	0.564	0.648	0.000	2.422
	LAT CL					0.225			0.326		0.000	0.000	0.551
	HEATNG	-0.072	-0.017	0.000	0.000	-0.032	-0.021	0.012	0.044	0.023	0.033	0.000	-0.032
JUL	SEN CL	0.591	0.252	0.000	0.000	0.052	-0.038	0.589	0.575	0.623	0.733	0.000	3.377
	LAT CL					0.433			0.382		0.000	0.000	0.816
	HEATNG	-0.101	-0.026	0.000	0.000	-0.045	-0.032	0.020	0.061	0.030	0.046	0.000	-0.045
AUG	SEN CL	0.481	0.231	0.000	0.000	-0.004	-0.067	0.532	0.557	0.615	0.720	0.000	3.065
	LAT CL					0.393			0.371		0.000	0.000	0.763
	HEATNG	-0.521	-0.099	0.000	0.000	-0.209	-0.132	0.069	0.194	0.123	0.188	0.000	-0.386
SEP	SEN CL	-0.153	0.062	0.000	0.000	-0.138	-0.125	0.387	0.408	0.507	0.553	0.000	1.502
	LAT CL					0.135			0.277		0.000	0.000	0.411
	HEATNG	-1.859	-0.318	0.000	0.000	-0.694	-0.426	0.209	0.451	0.376	0.513	0.000	-1.750
OCT	SEN CL	-0.253	-0.026	0.000	0.000	-0.091	-0.077	0.129	0.167	0.270	0.253	0.000	0.372
	LAT CL					0.027			0.118		0.000	0.000	0.145
	HEATNG	-2.943	-0.518	0.000	0.000	-1.034	-0.634	0.153	0.564	0.555	0.676	0.000	-3.181
NOV	SEN CL	-0.092	-0.013	0.000	0.000	-0.030	-0.025	0.025	0.043	0.079	0.064	0.000	0.050
	LAT CL					0.003			0.030		0.000	0.000	0.034
	HEATNG	-4.324	-0.769	0.000	0.000	-1.468	-0.906	0.169	0.617	0.639	0.758	0.000	-5.283
DEC	SEN CL	-0.013	-0.002	0.000	0.000	-0.002	-0.002	0.000	0.005	0.011	0.007	0.000	0.004
	LAT CL					0.001			0.004		0.000	0.000	0.004
	HEATNG	-26.246	-4.544	0.000	0.000	-9.367	-5.777	2.018	4.602	4.285	5.355	0.000	-29.673
TOT	SEN CL	0.205	0.743	0.000	0.000	-0.537	-0.654	2.761	2.703	3.349	3.658	0.000	12.228
	LAT CL					1.243			1.827		0.000	0.000	3.071

REPORT- LS-F Building Monthly Load Component WEATHER FILE- Toronto ON CWEC

(UNITS=MBTU)		WALLS	ROOFS	INT SUR	UND SUR	INFIL	WIN CON	WIN SOL	OCCUP	LIGHTS	EQUIP	SOURCE	TOTAL
	HEATNG	-4.873	-0.857	0.000	0.000	-1.684	-1.029	0.234	0.622	0.650	0.765	0.000	-6.172
JAN	SEN CL	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	LAT CL					0.000			0.000		0.000	0.000	0.000
	HEATNG	-4.337	-0.746	0.000	0.000	-1.513	-0.928	0.281	0.559	0.583	0.688	0.000	-5.414
FEB	SEN CL	-0.006	-0.001	0.000	0.000	-0.001	-0.001	0.002	0.002	0.004	0.004	0.000	0.002
	LAT CL					0.000			0.001		0.000	0.000	0.001
	HEATNG	-3.761	-0.615	0.000	0.000	-1.348	-0.834	0.349	0.606	0.619	0.740	0.000	-4.245
MAR	SEN CL	-0.041	-0.003	0.000	0.000	-0.012	-0.012	0.020	0.016	0.030	0.026	0.000	0.024
	LAT CL					0.000			0.011		0.000	0.000	0.011
	HEATNG	-2.235	-0.352	0.000	0.000	-0.847	-0.516	0.299	0.472	0.415	0.554	0.000	-2.211
APR	SEN CL	-0.210	-0.004	0.000	0.000	-0.084	-0.073	0.151	0.123	0.207	0.187	0.000	0.297
	LAT CL					0.002			0.088		0.000	0.000	0.090
	HEATNG	-0.968	-0.172	0.000	0.000	-0.387	-0.246	0.173	0.300	0.208	0.302	0.000	-0.792
MAY	SEN CL	-0.269	0.073	0.000	0.000	-0.160	-0.138	0.389	0.318	0.438	0.464	0.000	1.114
	LAT CL					0.025			0.218		0.000	0.000	0.243
	HEATNG	-0.252	-0.054	0.000	0.000	-0.106	-0.072	0.051	0.113	0.066	0.093	0.000	-0.161
JUN	SEN CL	0.171	0.174	0.000	0.000	-0.066	-0.094	0.536	0.489	0.564	0.648	0.000	2.422
	LAT CL					0.225			0.326		0.000	0.000	0.551
	HEATNG	-0.072	-0.017	0.000	0.000	-0.032	-0.021	0.012	0.044	0.023	0.033	0.000	-0.032
JUL	SEN CL	0.591	0.252	0.000	0.000	0.052	-0.038	0.589	0.575	0.623	0.733	0.000	3.377
	LAT CL					0.433			0.382		0.000	0.000	0.816
	HEATNG	-0.101	-0.026	0.000	0.000	-0.045	-0.032	0.020	0.061	0.030	0.046	0.000	-0.045
AUG	SEN CL	0.481	0.231	0.000	0.000	-0.004	-0.067	0.532	0.557	0.615	0.720	0.000	3.065
	LAT CL					0.393			0.371		0.000	0.000	0.763
	HEATNG	-0.521	-0.099	0.000	0.000	-0.209	-0.132	0.069	0.194	0.123	0.188	0.000	-0.386
SEP	SEN CL	-0.153	0.062	0.000	0.000	-0.138	-0.125	0.387	0.408	0.507	0.553	0.000	1.502
	LAT CL					0.135			0.277		0.000	0.000	0.411
	HEATNG	-1.859	-0.318	0.000	0.000	-0.694	-0.426	0.209	0.451	0.376	0.513	0.000	-1.750
OCT	SEN CL	-0.253	-0.026	0.000	0.000	-0.091	-0.077	0.129	0.167	0.270	0.253	0.000	0.372
	LAT CL					0.027			0.118		0.000	0.000	0.145
	HEATNG	-2.943	-0.518	0.000	0.000	-1.034	-0.634	0.153	0.564	0.555	0.676	0.000	-3.181
NOV	SEN CL	-0.092	-0.013	0.000	0.000	-0.030	-0.025	0.025	0.043	0.079	0.064	0.000	0.050
	LAT CL					0.003			0.030		0.000	0.000	0.034
	HEATNG	-4.324	-0.769	0.000	0.000	-1.468	-0.906	0.169	0.617	0.639	0.758	0.000	-5.283
DEC	SEN CL	-0.013	-0.002	0.000	0.000	-0.002	-0.002	0.000	0.005	0.011	0.007	0.000	0.004
	LAT CL					0.001			0.004		0.000	0.000	0.004
	HEATNG	-26.246	-4.544	0.000	0.000	-9.367	-5.777	2.018	4.602	4.285	5.355	0.000	-29.673
TOT	SEN CL	0.205	0.743	0.000	0.000	-0.537	-0.654	2.761	2.703	3.349	3.658	0.000	12.228
	LAT CL					1.243			1.827		0.000	0.000	3.071

REPORT- LS-K Space Input Fuels Summary EL1 SW Perim Spc (G.SW1) WEATHER FILE- Toronto ON CWEC

SPACE EL1 SW Perim Spc (G.SW1)

	- - - - L I G H T I N G - - - -		E Q U I P M E N T	- - - - - - - - - - - P R O C E S S	- - - - - - - - - -	
MONTH	TASK LIGHTING (KWH)	TOTAL LIGHTING (KWH)	GENERAL EQUIPMENT (KWH)	PROCESS ELECTRIC (KWH)	PROCESS GAS (MBTU)	PROCESS HOT WATER (MBTU)
JAN	0.00	199.56	229.02	0.00	0.0000	0.0000
FEB	0.00	180.21	206.86	0.00	0.0000	0.0000
MAR	0.00	199.43	229.02	0.00	0.0000	0.0000
APR	0.00	191.05	221.63	0.00	0.0000	0.0000
MAY	0.00	198.45	229.02	0.00	0.0000	0.0000
JUN	0.00	193.39	221.63	0.00	0.0000	0.0000
JUL	0.00	198.32	229.02	0.00	0.0000	0.0000
AUG	0.00	198.45	229.02	0.00	0.0000	0.0000
SEP	0.00	193.39	221.63	0.00	0.0000	0.0000
OCT	0.00	198.32	229.02	0.00	0.0000	0.0000
NOV	0.00	194.87	221.63	0.00	0.0000	0.0000
DEC	0.00	199.56	229.02	0.00	0.0000	0.0000
ANNUAL	0.00	2345.02	2696.48	0.00	0.0000	0.0000

REPORT- LS-K Building Input Fuels Summary WEATHER FILE- Toronto ON CWEC

BUILDING

MONTH	TASK LIGHTING (KWH)	TOTAL LIGHTING (KWH)	GENERAL EQUIPMENT (KWH)	PROCESS ELECTRIC (KWH)	PROCESS GAS (MBTU)	PROCESS HOT WATER (MBTU)
	- - - - L I G H T I N G - - - -		E Q U I P M E N T	- - - - - - - - - - P R O C E S S - - - - - - - - - -		
JAN	0.00	199.56	229.02	0.00	0.0000	0.0000
FEB	0.00	180.21	206.86	0.00	0.0000	0.0000
MAR	0.00	199.43	229.02	0.00	0.0000	0.0000
APR	0.00	191.05	221.63	0.00	0.0000	0.0000
MAY	0.00	198.45	229.02	0.00	0.0000	0.0000
JUN	0.00	193.39	221.63	0.00	0.0000	0.0000
JUL	0.00	198.32	229.02	0.00	0.0000	0.0000
AUG	0.00	198.45	229.02	0.00	0.0000	0.0000
SEP	0.00	193.39	221.63	0.00	0.0000	0.0000
OCT	0.00	198.32	229.02	0.00	0.0000	0.0000
NOV	0.00	194.87	221.63	0.00	0.0000	0.0000
DEC	0.00	199.56	229.02	0.00	0.0000	0.0000
ANNUAL	0.00	2345.02	2696.48	0.00	0.0000	0.0000

REPORT- LS-L Management and Solar Summary EL1 SW Perim Spc (G.SW1) WEATHER FILE- Toronto ON CWEC

DATA FOR SPACE EL1 SW Perim Spc (G.SW1)

MONTH	NUMBER OF HOURS MANAGEMENT WOULD BE EMPLOYED	AVERAGE DAILY SOLAR RADIATION INTO SPACE (BTU/DAY)	MAXIMUM HOURLY SOLAR RADIATION INTO SPACE (BTU/HR)
JAN	0.	8172.697	2956.210
FEB	0.	11041.780	3364.959
MAR	0.	12903.388	3342.341
APR	0.	16302.553	3386.277
MAY	0.	19735.270	3100.000
JUN	0.	21292.117	2979.260
JUL	0.	21021.580	3025.078
AUG	0.	19355.691	3187.154
SEP	0.	16448.883	3066.478
OCT	0.	11800.177	3173.628
NOV	0.	6426.119	2960.308
DEC	0.	5964.462	2810.425
ANNUAL	0.	14221.378	3386.277

```
 **WARNING**********************************************************************
            Loop: DHW Plant 1 Res Loop (1)         heating capacity is smaller
            than the secondary demand. Primary=    -2000.
             Secondary=   -12127.

 **WARNING**********************************************************************
            Energy-recovery ventilator: EL1 Sys1 (PTAC) (G.SW1)          has
            condensation on the exhaust outlet.  First occurrence:  1 30 23
            OA T&W:  34.0  0.0039   Return T&W:  71.4  0.0047

 **WARNING**********************************************************************
            Energy-recovery ventilator: EL1 Sys1 (PTAC) (G.SW1)          has
            frost on the exhaust outlet.  First occurrence:  2 25 22
            OA T&W:  14.0  0.0014   Return T&W:  70.5  0.0023
```

REPORT- SV-A System Design Parameters for EL1 Sys1 (PTAC) (G.SW1) WEATHER FILE- Toronto ON CWEC

SYSTEM TYPE	ALTITUDE FACTOR	FLOOR AREA (SQFT)	MAX PEOPLE	OUTSIDE AIR RATIO	COOLING CAPACITY (KBTU/HR)	SENSIBLE (SHR)	HEATING CAPACITY (KBTU/HR)	COOLING EIR (BTU/BTU)	HEATING EIR (BTU/BTU)	HEAT PUMP SUPP-HEAT (KBTU/HR)
PSZ	1.050	1584.0	5.	0.186	2.621	6.766	-34.584	0.360	0.273	-27.358

FAN TYPE	CAPACITY (CFM)	DIVERSITY FACTOR (FRAC)	POWER DEMAND (KW)	FAN DELTA-T (F)	STATIC PRESSURE (IN-WATER)	TOTAL EFF (FRAC)	MECH EFF (FRAC)	FAN PLACEMENT	FAN CONTROL	MAX FAN RATIO (FRAC)	MIN FAN RATIO (FRAC)
SUPPLY	840.	1.00	0.142	0.55	0.5	0.33	0.62	DRAW-THRU	2-SPEED	1.10	0.30

ZONE NAME	SUPPLY FLOW (CFM)	EXHAUST FLOW (CFM)	FAN (KW)	MINIMUM FLOW (FRAC)	OUTSIDE AIR FLOW (CFM)	COOLING CAPACITY (KBTU/HR)	SENSIBLE (FRAC)	EXTRACTION RATE (KBTU/HR)	HEATING CAPACITY (KBTU/HR)	ADDITION RATE (KBTU/HR)	ZONE MULT
EL1 SW Perim Zn (G.SW1)	840.	0.	0.000	1.000	156.	0.00	0.00	17.28	0.00	-15.55	1.

REPORT- SS-D Building HVAC Load Summary WEATHER FILE- Toronto ON CWEC

	COOLING						HEATING						ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000	31	24	24.F	22.F	0.000	-5.307	1	17	12.F	11.F	-25.832	1908.	8.816
FEB	0.00000	28	24	22.F	20.F	0.000	-4.603	22	20	5.F	4.F	-25.406	1676.	9.094
MAR	0.00043	24	17	65.F	53.F	0.372	-3.340	10	17	20.F	19.F	-17.558	1346.	5.540
APR	0.03475	14	19	61.F	46.F	3.529	-1.276	4	4	16.F	13.F	-15.897	1019.	3.752
MAY	0.57104	31	19	74.F	61.F	6.247	-0.209	2	4	33.F	29.F	-8.632	907.	2.877
JUN	1.78247	17	19	78.F	74.F	6.686	-0.002	6	4	44.F	43.F	-0.583	893.	2.912
JUL	2.44872	7	18	86.F	73.F	6.757	-0.001	23	4	50.F	47.F	-0.415	938.	2.925
AUG	2.33872	4	18	74.F	73.F	6.847	0.000	25	8	51.F	45.F	-0.280	933.	2.918
SEP	1.06598	5	19	74.F	66.F	6.502	-0.011	29	8	36.F	35.F	-3.680	871.	2.900
OCT	0.13349	11	19	69.F	63.F	4.830	-0.900	22	24	19.F	18.F	-14.347	995.	3.825
NOV	0.00033	1	21	49.F	46.F	0.131	-2.239	13	18	26.F	25.F	-16.216	1152.	4.103
DEC	0.00000	31	24	15.F	13.F	0.000	-4.290	23	18	19.F	17.F	-22.640	1559.	7.605
TOTAL	8.376						-22.178						14195.	
MAX						6.847						-25.832		9.094

MAXIMUM DAILY INTEGRATED COOLING LOAD (DES DAY) 0.000 (KBTU)
MAXIMUM DAILY INTEGRATED COOLING LOAD (WTH FILE) 0.000 (KBTU)

REPORT- SS-E Building HVAC Load Hours WEATHER FILE- Toronto ON CWEC

MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
	- - - - - N U M B E R			O F		H O U R S - - - - -					--COINCIDENT LOADS--	
JAN	0	464	0	280	744	744	464	0	0	0	-12.768	2.502
FEB	0	419	0	253	672	672	419	0	0	0	-13.654	2.685
MAR	2	453	0	289	744	744	464	0	0	9	0.000	1.364
APR	31	279	0	410	720	720	444	0	0	134	0.000	2.849
MAY	221	81	0	442	744	744	461	0	0	159	0.000	2.874
JUN	405	3	0	312	720	720	450	0	0	42	0.000	2.912
JUL	459	2	0	283	744	744	461	0	0	0	0.000	2.782
AUG	457	1	0	286	744	744	461	0	0	3	0.000	2.775
SEP	322	8	0	390	720	720	450	0	0	120	0.000	2.889
OCT	93	230	0	421	744	744	461	0	0	138	0.000	2.876
NOV	5	393	0	322	720	720	453	0	0	55	0.000	2.374
DEC	0	462	0	282	744	744	464	0	0	2	-18.084	4.231
ANNUAL	1995	2795	0	3970	8760	8760	5452	0	0	662		

REPORT- SS-M Building HVAC Fan Elec Energy WEATHER FILE- Toronto ON CWEC

MONTH	FAN ELECTRIC ENERGY DURING HEATING (KWH)	FAN ELECTRIC ENERGY DURING COOLING (KWH)	FAN ELECTRIC ENERGY DURING HEATING-COOLING (KWH)	FAN ELECTRIC ENERGY DURING FLOATING (KWH)
JAN	397.638	0.000	0.000	0.000
FEB	359.866	0.000	0.000	0.000
MAR	390.695	2.077	0.000	7.554
APR	238.669	29.506	0.000	118.552
MAY	56.338	200.840	0.000	138.241
JUN	0.427	355.185	0.000	32.864
JUL	0.285	400.511	0.000	0.000
AUG	0.142	396.642	0.000	1.323
SEP	2.034	287.808	0.000	98.634
OCT	189.572	89.415	0.000	116.432
NOV	332.864	5.193	0.000	49.950
DEC	400.938	0.000	0.000	2.077
ANNUAL	2369.491	1767.193	0.000	565.627

REPORT- SS-A System Loads Summary for EL1 Sys1 (PTAC) (G.SW1) WEATHER FILE- Toronto ON CWEC

	COOLING						HEATING						ELEC	
MONTH	COOLING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM COOLING LOAD (KBTU/HR)	HEATING ENERGY (MBTU)	TIME OF MAX DY	TIME OF MAX HR	DRY-BULB TEMP	WET-BULB TEMP	MAXIMUM HEATING LOAD (KBTU/HR)	ELEC-TRICAL ENERGY (KWH)	MAXIMUM ELEC LOAD (KW)
JAN	0.00000	31	24	24.F	22.F	0.000	-5.307	1	17	12.F	11.F	-25.832	1908.	8.816
FEB	0.00000	28	24	22.F	20.F	0.000	-4.603	22	20	5.F	4.F	-25.406	1676.	9.094
MAR	0.00043	24	17	65.F	53.F	0.372	-3.340	10	17	20.F	19.F	-17.558	1346.	5.540
APR	0.03475	14	19	61.F	46.F	3.529	-1.276	4	4	16.F	13.F	-15.897	1019.	3.752
MAY	0.57104	31	19	74.F	61.F	6.247	-0.209	2	4	33.F	29.F	-8.632	907.	2.877
JUN	1.78247	17	19	78.F	74.F	6.686	-0.002	6	4	44.F	43.F	-0.583	893.	2.912
JUL	2.44872	7	18	86.F	73.F	6.757	-0.001	23	4	50.F	47.F	-0.415	938.	2.925
AUG	2.33872	4	18	74.F	73.F	6.847	0.000	25	8	51.F	45.F	-0.280	933.	2.918
SEP	1.06598	5	19	74.F	66.F	6.502	-0.011	29	8	36.F	35.F	-3.680	871.	2.900
OCT	0.13349	11	19	69.F	63.F	4.830	-0.900	22	24	19.F	18.F	-14.347	995.	3.825
NOV	0.00033	1	21	49.F	46.F	0.131	-2.239	13	18	26.F	25.F	-16.216	1152.	4.103
DEC	0.00000	31	24	15.F	13.F	0.000	-4.290	23	18	19.F	17.F	-22.640	1559.	7.605
TOTAL	8.376						-22.178						14195.	
MAX						6.847						-25.832		9.094

REPORT- SS-B System Loads Summary for EL1 Sys1 (PTAC) (G.SW1) WEATHER FILE- Toronto ON CWEC

MONTH	- -Z O N E C O O L I N G- - COOLING BY ZONE COILS OR NAT VENTIL (MBTU)	MAXIMUM COOLING BY ZONE COILS OR NAT VENTIL (KBTU/HR)	- -Z O N E H E A T I N G- HEATING BY ZONE COILS OR FURNACE (MBTU)	MAXIMUM HEATING BY ZONE COILS OR FURNACE (KBTU/HR)	- - B A S E B O A R D S - - BASEBOARD HEATING ENERGY (MBTU)	MAXIMUM BASEBOARD HEATING ENERGY (KBTU/HR)	--PREHEAT OR FURN FAN ELEC-- PREHEAT COIL ENERGY OR ELEC FOR FURN FAN (MBTU)	MAXIMUM PREHEAT COIL ENERGY OR ELEC FOR FURN FAN (KBTU/HR)
JAN	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
FEB	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
MAR	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
APR	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
MAY	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
JUN	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
JUL	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
AUG	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
SEP	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
OCT	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
NOV	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
DEC	0.00000	0.000	0.00000	0.000	0.00000	0.000	0.00000	0.000
TOTAL	0.000		0.000		0.000		0.000	
MAX		0.000		0.000		0.000		0.000

REPORT- SS-C System Load Hours for EL1 Sys1 (PTAC) (G.SW1) WEATHER FILE- Toronto ON CWEC

	NUMBER OF HOURS										COINCIDENT LOADS	
MONTH	HOURS COOLING LOAD	HOURS HEATING LOAD	HOURS COINCIDENT COOL-HEAT LOAD	HOURS FLOATING	HOURS HEATING AVAIL.	HOURS COOLING AVAIL.	HOURS FANS ON	HOURS FANS CYCLE ON	HOURS NIGHT VENTING	HOURS FLOATING WHEN FANS ON	HEATING LOAD AT COOLING PEAK (KBTU/HR)	ELECTRIC LOAD AT COOLING PEAK (KW)
JAN	0	464	0	280	744	744	464	0	0	0	-12.768	2.502
FEB	0	419	0	253	672	672	419	0	0	0	-13.654	2.685
MAR	2	453	0	289	744	744	464	0	0	9	0.000	1.364
APR	31	279	0	410	720	720	444	0	0	134	0.000	2.849
MAY	221	81	0	442	744	744	461	0	0	159	0.000	2.874
JUN	405	3	0	312	720	720	450	0	0	42	0.000	2.912
JUL	459	2	0	283	744	744	461	0	0	0	0.000	2.782
AUG	457	1	0	286	744	744	461	0	0	3	0.000	2.775
SEP	322	8	0	390	720	720	450	0	0	120	0.000	2.889
OCT	93	230	0	421	744	744	461	0	0	138	0.000	2.876
NOV	5	393	0	322	720	720	453	0	0	55	0.000	2.374
DEC	0	462	0	282	744	744	464	0	0	2	-18.084	4.231
ANNUAL	1995	2795	0	3970	8760	8760	5452	0	0	662		

U.S. DEPARTMENT OF ENERGY
SOLAR DECATHLON 2020
BUILD COMPETITION

Kaikaiknong Crescent Development

Engineering Narrative

BC_WH_JURYENG

Submission Date: 03/02/21

Warrior Home

Student Design Team

University of Waterloo

Waterloo, ON, Canada

info@warriorhome.ca

WARRIOR HOME